



TITLE:

Erratum: "A convergence study for the Laguerre expansion in the moment equation method for neoclassical transport in general toroidal plasmas" [Phys. Plasmas 17, 082510 (2010)]

AUTHOR(S):

Nishimura, S.; Sugama, H.; Maassberg, H.; Beidler, C. D.; Murakami, S.; Nakamura, Y.; Hirooka, S.

CITATION:

Nishimura, S. ...[et al]. Erratum: "A convergence study for the Laguerre expansion in the moment equation method for neoclassical transport in general toroidal plasmas" [Phys. Plasmas 17, 082510 (2010)]. PHYSICS OF PLASMAS 2011, 18(6): 069901.

ISSUE DATE:

2011-06

URL:

<http://hdl.handle.net/2433/160675>

RIGHT:

Copyright 2011 American Institute of Physics. This article may be downloaded for personal use only. Any other use requires prior permission of the author and the American Institute of Physics. The following article appeared in PHYSICS OF PLASMAS 18, 069901 (2011) and may be found at <http://link.aip.org/link/?php/18/069901>



Erratum: "A convergence study for the Laguerre expansion in the moment equation method for neoclassical transport in general toroidal plasmas" [Phys. Plasmas 17, 082510 (2010)]

S. Nishimura, H. Sugama, H. Maaßberg, C. D. Beidler, S. Murakami et al.

Citation: [Phys. Plasmas](#) **18**, 069901 (2011); doi: 10.1063/1.3595673

View online: <http://dx.doi.org/10.1063/1.3595673>

View Table of Contents: <http://pop.aip.org/resource/1/PHPAEN/v18/i6>

Published by the [American Institute of Physics](#).

Related Articles

Clocking convergence to a stable limit cycle of a periodically driven nonlinear pendulum
[Chaos](#) **22**, 033138 (2012)

On the joint distribution of the maximum and its position of the Airy2 process minus a parabola
[J. Math. Phys.](#) **53**, 083303 (2012)

Small signal stability analysis of photovoltaic array based on averaged switch modeling technique
[J. Renewable Sustainable Energy](#) **4**, 043117 (2012)

Quasigraded bases in loop algebras and classical rational r-matrices
[J. Math. Phys.](#) **53**, 083501 (2012)

On the size-consistency of the reduced-density-matrix method and the unitary invariant diagonal N-representability conditions
[AIP Advances](#) **2**, 032125 (2012)

Additional information on Phys. Plasmas


Journal Homepage: <http://pop.aip.org/>

Journal Information: http://pop.aip.org/about/about_the_journal

Top downloads: http://pop.aip.org/features/most_downloaded

Information for Authors: <http://pop.aip.org/authors>

ADVERTISEMENT



AIPAdvances

Special Topic Section:
PHYSICS OF CANCER

Why cancer? Why physics?

[View Articles Now](#)

Erratum: “A convergence study for the Laguerre expansion in the moment equation method for neoclassical transport in general toroidal plasmas” [Phys. Plasmas **17**, 082510 (2010)]

S. Nishimura,^{1,a)} H. Sugama,¹ H. Maaßberg,² C. D. Beidler,² S. Murakami,³ Y. Nakamura,⁴ and S. Hirooka⁴

¹National Institute for Fusion Science, Toki 509-5292, Japan

²Max-Planck-Institut für Plasmaphysik, EURATOM Association, Teilinstitut Greifswald, Greifswald D-17491, Germany

³Department of Engineering, Kyoto University, Kyoto 606-8501, Japan

⁴Graduate School of Energy Science, Kyoto University, Uji 611-0011, Japan

(Received 9 May 2011; accepted 9 May 2011; published online 13 June 2011)

[doi:10.1063/1.3595673]

In making the numerical examples in Sec. IV of Ref. 1, there were two mistakes. One is that the parallel viscosity matrix elements

$$\begin{bmatrix} M_{11}^a & M_{12}^a & M_{13}^a & M_{14}^a \\ M_{21}^a & M_{22}^a & M_{23}^a & M_{24}^a \\ M_{31}^a & M_{32}^a & M_{33}^a & M_{34}^a \\ M_{41}^a & M_{42}^a & M_{43}^a & M_{44}^a \end{bmatrix} \quad (1)$$

are replaced by

$$\begin{bmatrix} M_{11}^a & M_{12}^a & M_{13}^a & M_{14}^a \\ M_{21}^a & M_{12}^a & M_{13}^a & M_{14}^a \\ M_{31}^a & M_{31}^a & M_{13}^a & M_{14}^a \\ M_{41}^a & M_{41}^a & M_{41}^a & M_{14}^a \end{bmatrix}. \quad (2)$$

The detailed definition of these matrix elements is shown in Eqs. (41)–(44) in Ref. 2. Unfortunately, the check of the Onsager symmetry of the transport matrix (Eq. (13) in Ref. 1) $L_{ji}^{ba} = L_{ij}^{ab}$, $L_{Ej}^a = -L_{jE}^a$ could not find this mistake because a symmetric structure of the \mathbf{M}_a matrix is still formally retained. Furthermore, the check of the momentum conservation also failed to find the mistake since replaced $M_{j+1,k+1}^a$ with $j \geq 1$ are irrelevant to the parallel force moment of the lowest Laguerre order $j=0$. The mistake was found by a comparison with an analytical solution (with a small mass ratio approximation) in Appendix C in Ref. 3. This concentration on limited transport matrix elements caused also the second mistake, in which results in Figs. 2–3 were not consistent with radial gradients of the pressure and the temperature $\partial p_a/\partial r$, $\partial T_a/\partial r$ stated in the captions. In Fig. 3, the stated $\partial p_a/\partial r$ and $\partial T_a/\partial r$ are substituted correctly only for $E_r \leq 0$ and invalid values are used for $E_r > 0$. Therefore, the unnatural jumps are caused at $E_r=0$, but we had a misunderstanding on it that there will be the sharp dependence on E_r due to the boundary layer effect shown in Fig. 1(b). Now, we present the exact numerical examples in which the parallel viscosity coefficients $M_{j+1,k+1}^a$ and the radial gradients in the captions are correctly substituted.

^{a)}Electronic mail: nishimura.shin@lhd.nifs.ac.jp.

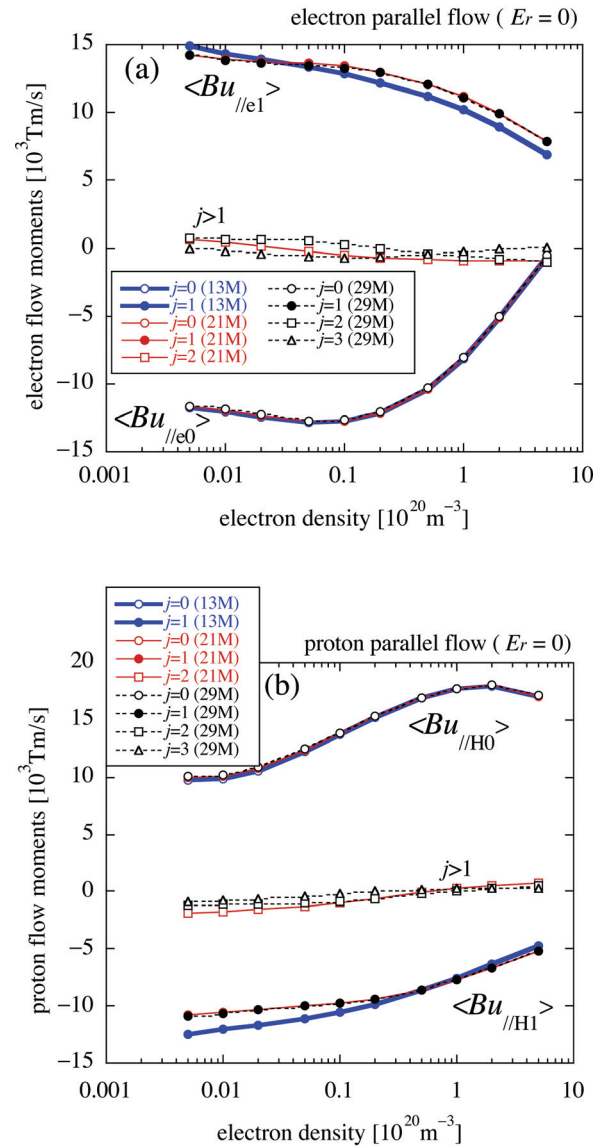


FIG. 1. (Color online) A comparison of flow moments $\langle Bu_{||aj} \rangle$ for (a) $a=e^-$ and (b) $a=H^+$ obtained by the 13 M, 21 M, and 29 M approximations as functions of the electron density in $e^- + H^+$ plasmas. Assumed parameters are $T_e = T_i = 2.0$ keV, $\partial p_e/\partial r/n_e = \partial p_i/\partial r/n_i = \partial T_e/\partial r = \partial T_i/\partial r = -3.0$ keV/m, and $E_r = \langle BE_{||}^{(A)} \rangle = 0$.

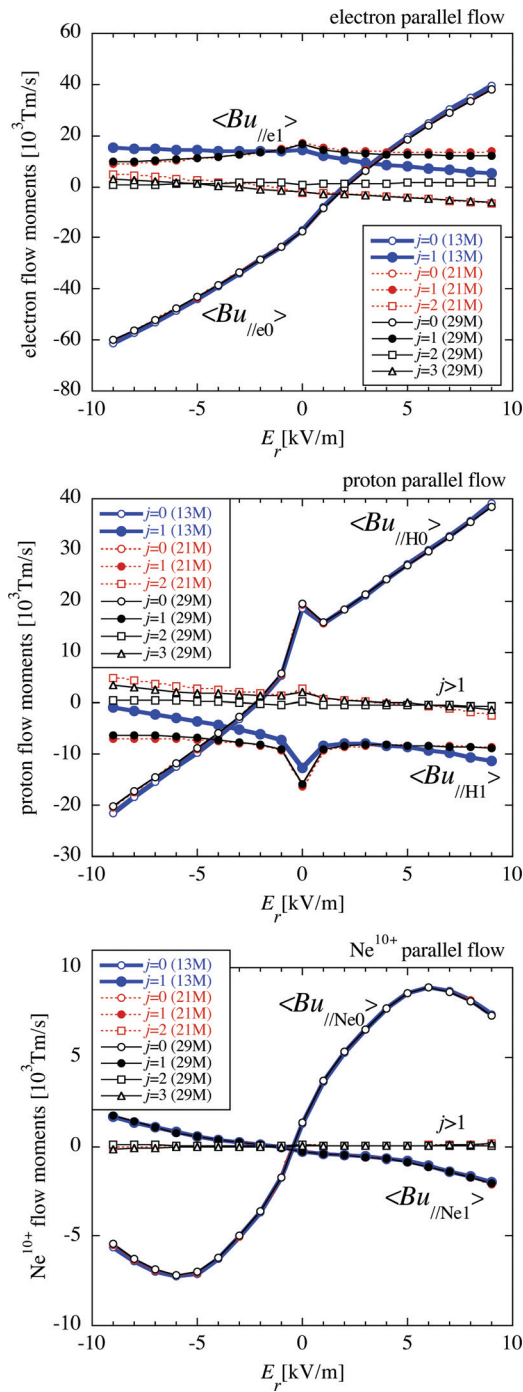


FIG. 2. (Color online) Another comparison of the flow moments $\langle Bu_{||aj} \rangle$ for $a = e^-, H^+, Ne^{10+}$ as functions of the radial electric field strength E_r by the three approximation methods in $e^- + H^+ + Ne^{10+}$ plasmas with $\langle BE_{||}^{(A)} \rangle = 0$. Assumed parameters are $T_e = 2.0$ keV, $T_i = 1.0$ keV, $Z_{eff} = 5.74$, $n_e = 1 \times 10^{18} \text{ m}^{-3}$, and $\partial p_e / \partial r / n_e = \partial p_i / \partial r / n_i = \partial T_e / \partial r = \partial T_i / \partial r = -3.0$ keV/m.

These corrections (especially that of $\partial p_a / \partial r$, $\partial T_a / \partial r$) mainly change the absolute values of the flow moments $\langle Bu_{||aj} \rangle$ and the bootstrap current and Ware pinch coefficients $L_{Ej}^a = -L_{jE}^a$. Their dependence on j_{max} (the maximum order of the Laguerre expansion) with relation to the particle mass and the radial electric field effect, which is an essential discussion point in Ref. 1, is unchanged.

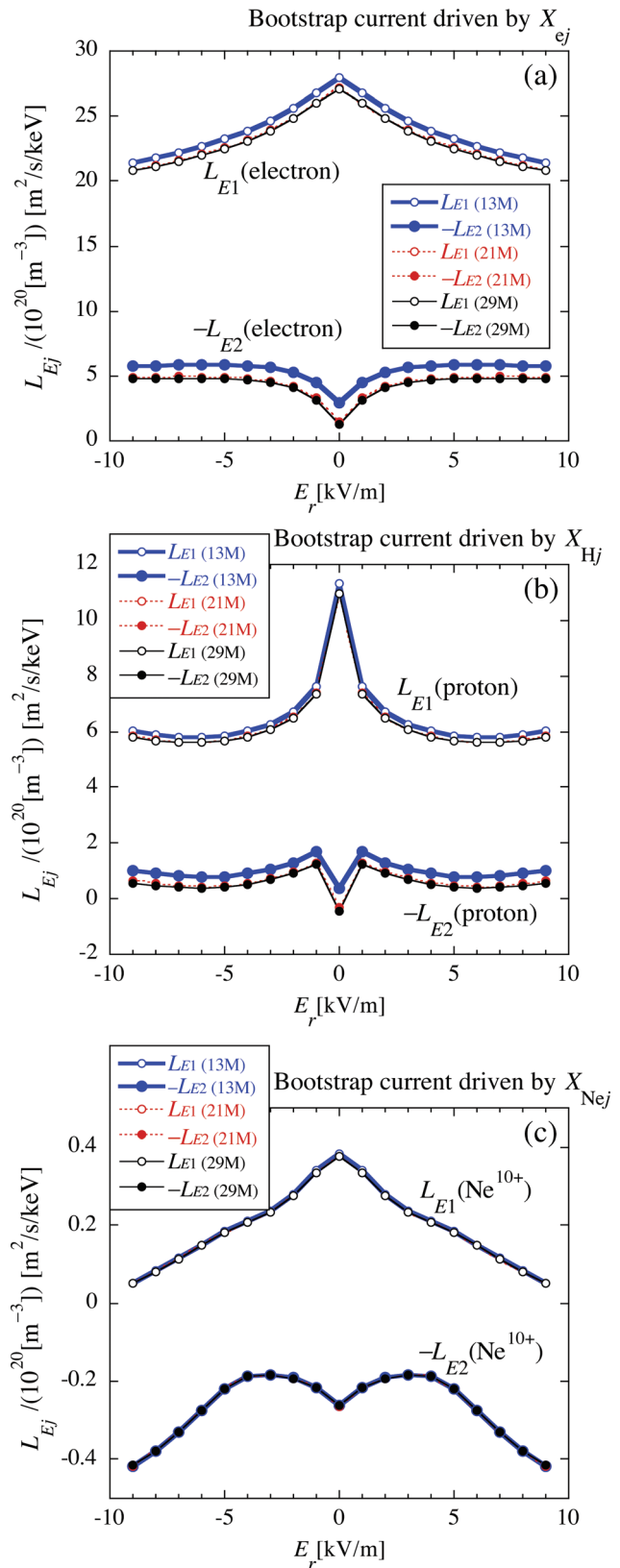


FIG. 3. (Color online) A comparison of the bootstrap current and Ware pinch coefficients $L_{E1}^a = -L_{1E}^a$ and $-L_{E2}^a = L_{2E}^a$ defined in Eq. (13) for the $e^- + H^+ + Ne^{10+}$ plasmas. Figures indicate the bootstrap current driven by (a) the electron forces $a = e^-$, (b) the proton forces $a = H^+$, and (c) the neon forces $a = Ne^{10+}$. The assumed parameters are those in Fig. 2.

Two authors (S.N. and Y.N.) thank a graduate school student Mr. Kenji Nishioka in Kyoto University for useful

discussions triggering our recalculation. This work is supported by coordinated research programs NIFS06KUHL007 and NIFS07KNXN103 in National Institute for Fusion Science.

- ¹S. Nishimura, H. Sugama, H. Maaßberg, C. D. Beidler, S. Murakami, Y. Nakamura, and S. Hirooka, [Phys. Plasmas](#) **17**, 082510 (2010).
²H. Sugama and S. Nishimura, [Phys. Plasmas](#) **15**, 042502 (2008).
³H. Sugama and S. Nishimura, [Phys Plasmas](#) **9**, 4637 (2002).